

Geobattleships

Do earthquakes and volcanoes coincide?

Arrange for students to sit in pairs. Give one student in each pair a copy of the Geobattleship Volcanoes map (face down on the table) together with a blank map (page 3): give the other student the Geobattleship Earthquakes map, also face down with a blank map too (page 4). Explain the rules of “Geobattleships” based on the popular children’s game, as follows: Students turn over their maps, but keep them hidden from their partners. The students with the Volcanoes maps each choose a square in which they think their partners may have an earthquake and call out its co-ordinates, e.g. “H2”. The partner will say “Hit” if there is an earthquake epicentre shown in that square, or “Miss” if the square is blank. The students who made the call mark the result on the blank map. Now the students with the Earthquake maps take their turn to see if they can “Hit” a volcano on their partners’ maps. Play continues alternately until a pattern begins to emerge and students realise that earthquakes and volcanoes both occur in relatively restricted belts, which are largely coincident. Note – in the

commercially published version of “Battleships” a successful “Hit” results in another turn, but with Geobattleships it is better if students simply take turns at calling.

There is no need to take the game to the point where every volcano and earthquake has been found, which could become tedious. Once the overall pattern has emerged, ask students to look at both printed maps carefully. Ask them if they can find any places where there are: a) earthquakes but no volcanoes; b) volcanoes but no earthquakes. The most notable region where earthquakes are common, but there are no volcanoes is the Himalayan mountain belt. Conversely, the Hawaiian Islands have active volcanoes, but no earthquakes other than minor tremors as magma works its way to the surface. From the maps it would seem that parts of the Indian and Pacific Oceans have earthquakes but no volcanoes: however there are underwater volcanoes which coincide with regular earthquakes – we have only shown oceanic volcanoes which have broken the surface during the last 10000 years and have formed islands.

The back up

Title: Geobattleships

Subtitle: Do earthquakes and volcanoes coincide?

Topic: Use a children’s game to match the distribution of volcanoes and earthquakes on the Earth’s surface

Age range of pupils: 11 -16 years

Time needed to complete activity: 5 minutes

Pupil learning outcomes: Pupils can:

- search for patterns on a map of the world;
- relate the distribution of volcanoes to that of earthquakes, and vice-versa;
- locate discrepancies between the two distribution maps.

Context: This activity provides a useful lead-in to the topic of plate tectonics and is best used before students have become too familiar with the theory

Following up the activity:

- Study the distribution of earthquakes and volcanoes on more detailed maps from the internet.
- Relate these distributions to the margins of the major plates.
- Use maps from the internet to study the distribution of earthquake foci at depth and relate these to the different types of plate boundary.

- Plot the locations of earthquakes on a weekly basis for a month or so, as they are reported on websites.

Underlying principles:

- Earthquakes and volcanoes are of restricted distribution and occur in well-marked belts around the world.
- In most cases, these belts are coincident, and are taken to mark the boundaries of tectonic plates in the Earth’s lithosphere (the lithosphere is the crust plus uppermost mantle).
- Beneath the Himalayas, two colliding continental plates descend to great depths and the pressure/temperature regime is not suitable for the melting of rocks or for any resultant magma to rise to the surface..
- Beneath the Hawaiian Islands, there is a hot spot in the mantle, which produces low viscosity magma. This can rise easily accompanied by minor tremors but no major earthquake activity.
- Earthquakes can and do occur sporadically in areas other than the mapped belts, but they are usually of low magnitude and of irregular distribution.

Thinking skill development:

Pupils construct a **pattern** of the distribution of earthquakes and volcanoes and realise that there is **cognitive conflict** when the patterns do not match in all areas. Applying the outcome of the game to the theory of plate tectonics involves **bridging**.

Resource list:

- Sets of sheets for pairs of students, as supplied. One student in each pair is handed a map of the distribution of volcanoes, with a blank map beneath. The other student is handed a map of the distribution of earthquakes with a blank map beneath.
- Pencils

<http://www.quakes.bgs.ac.uk/>

Source: Devised by David Turner, Highfields School Matlock, and included in the workshop titled, "The Earth and plate tectonics", Earth Science Education Unit.

<http://www.earthscienceeducation.com>. The ESEU maps are reproduced with permission. We are very grateful to Prof Steve Sparks, Bristol University for his comments on the draft of this activity.

Useful links:

<http://earthquake.usgs.gov/earthquakes/recenteqsww/index.php?old=world.html>

www.bgs.ac.uk/schoolseismology

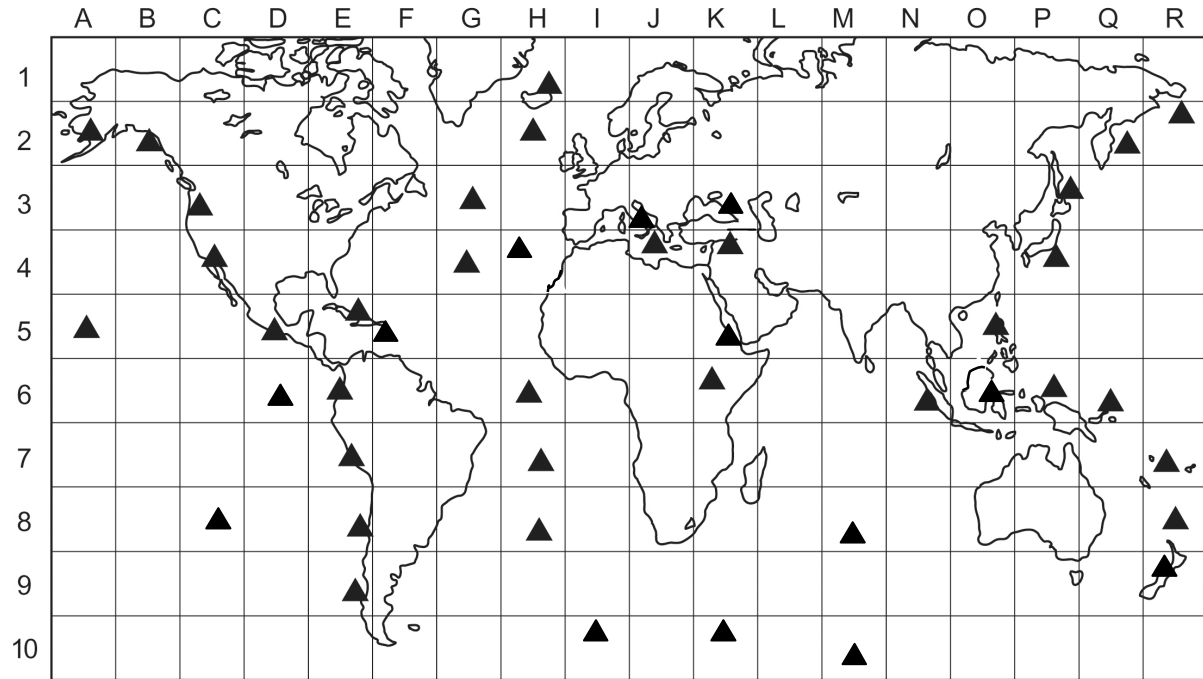
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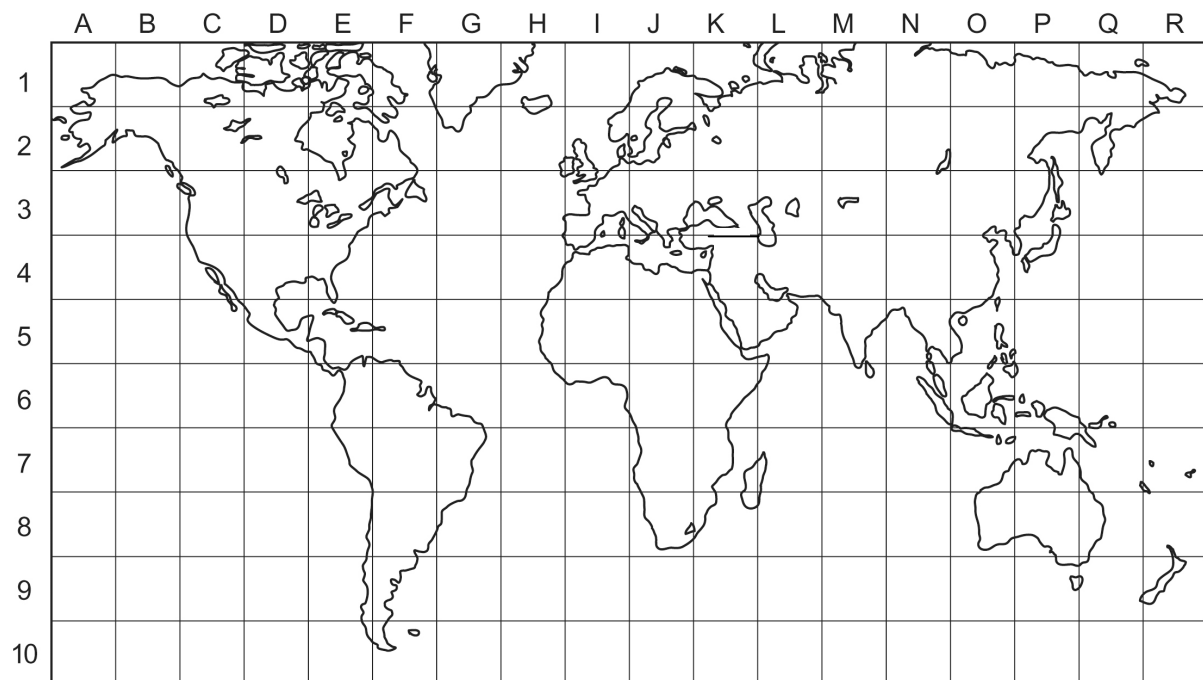
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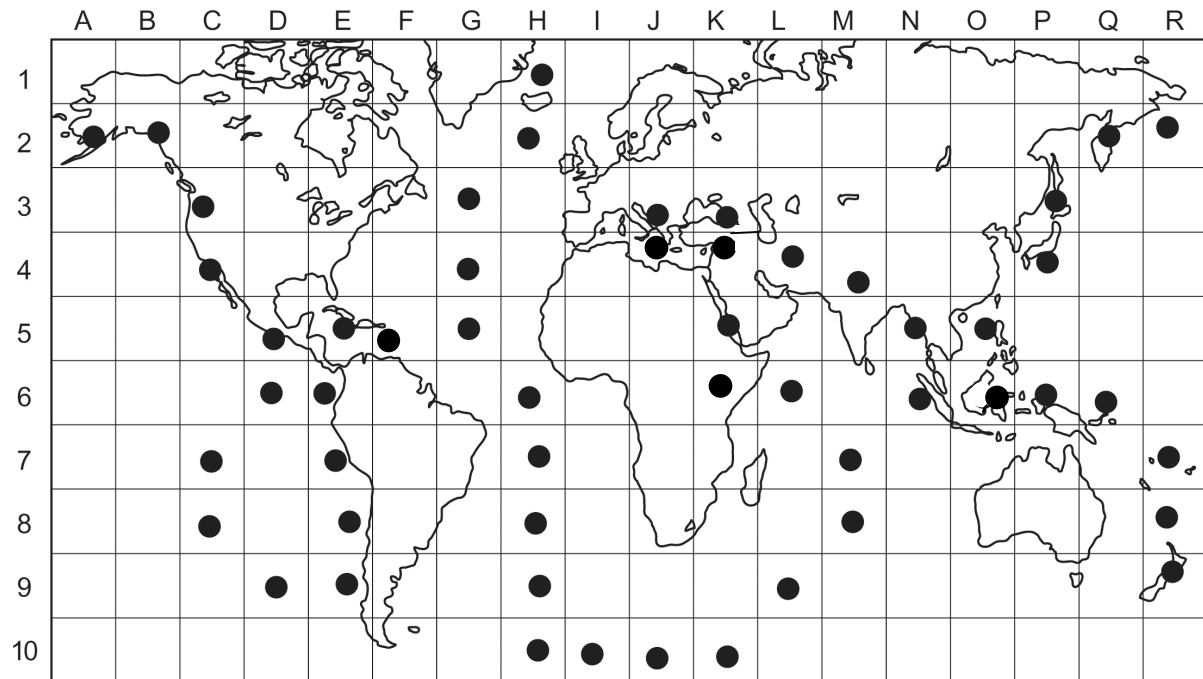
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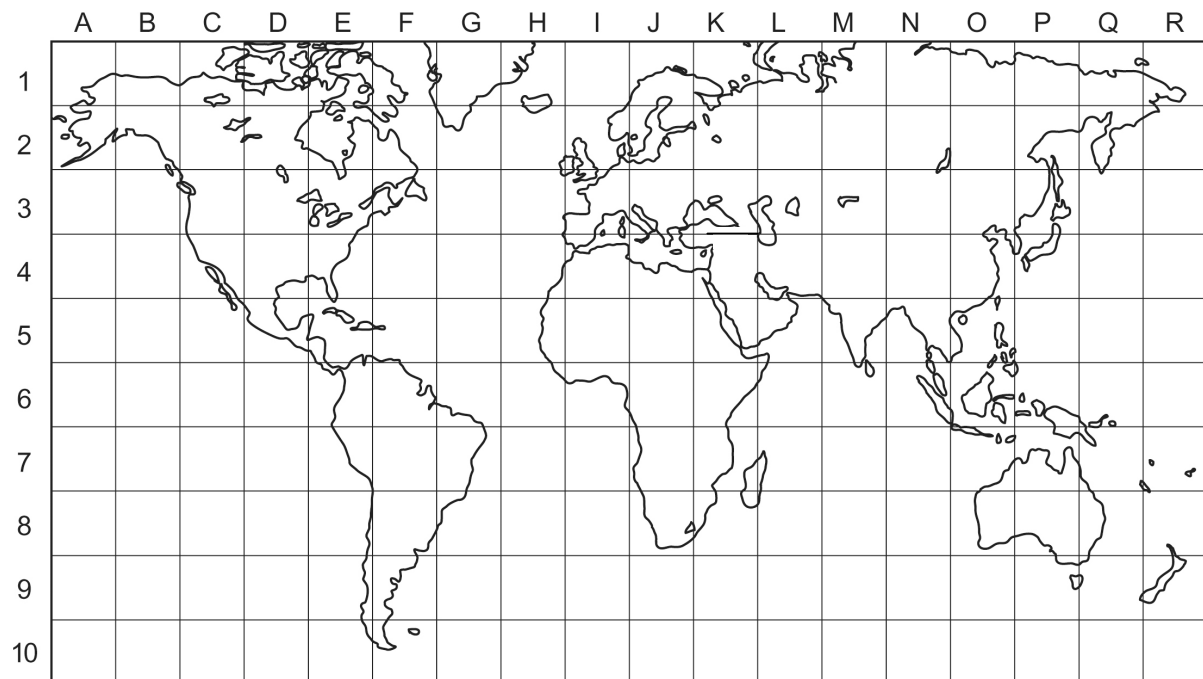
Main Volcanoes / Volcanic Activity



Map for plotting Earthquake locations



Main Earthquake Activity



Map for plotting Volcanoes / Volcanic activity locations